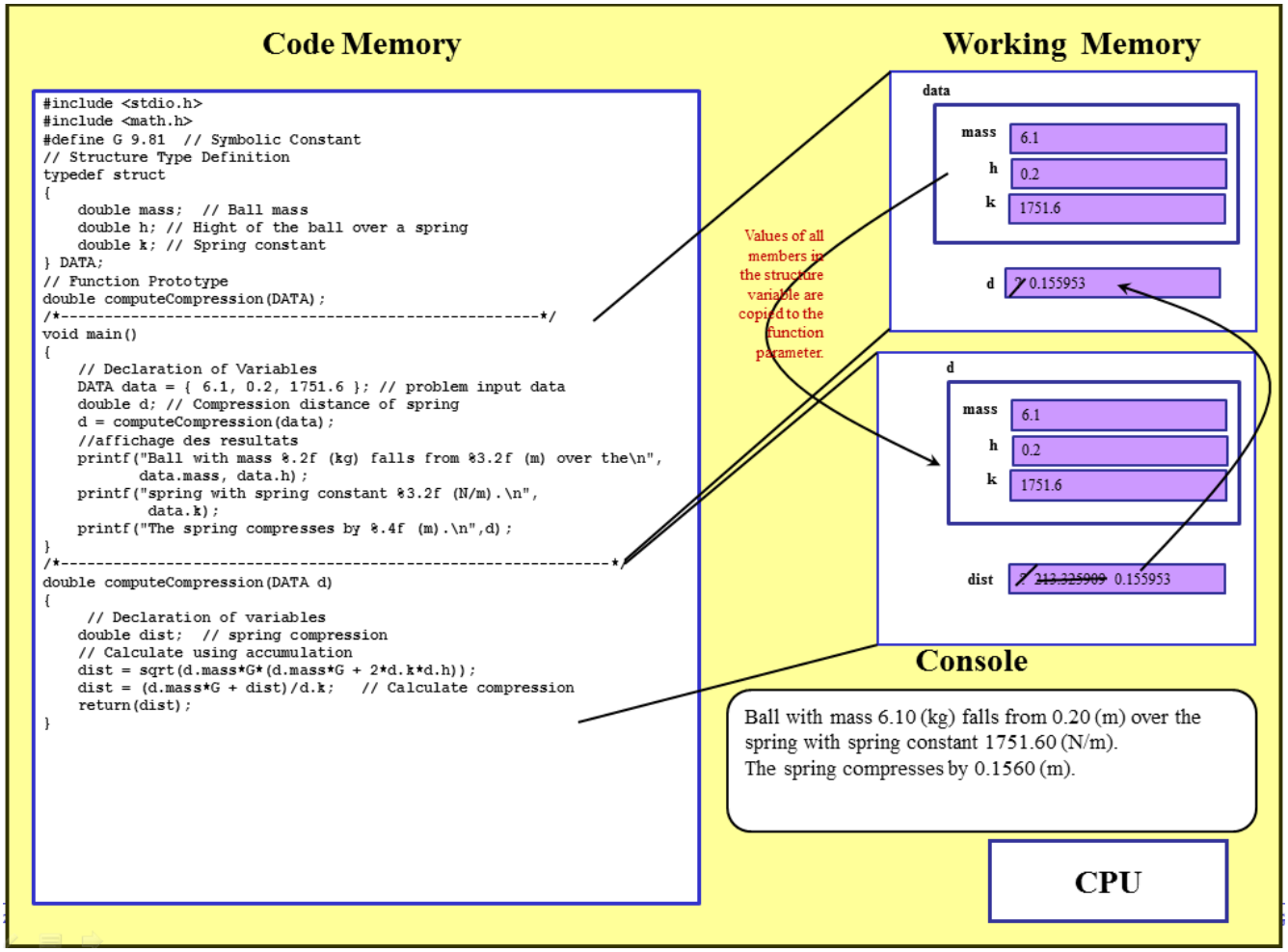
GNG1106 Fall 2017 - Assignment 3 Solution

Deduct 0 to 5 points for not submitting assignment according to instructions (in a zip file, directory, with source code, etc.)

Question 1 (15 marks)

(a) (10 marks)



Marking Scheme:

- Variables in working memory for main — 3.0 marks
  - Structure variable data
    - 1 for drawing structure variable in working memory
    - 0.75 for values (0.25 for each correct value)
    - -0.5 for adding ? in structure variable members
  - Simple variable d
    - 0.5 for drawing variable in working memory
    - 0.75 for values (0.25 for ? and updated values)
- Variables in working memory for function computeCompression — 3.5 marks
  - 1 for parameter (structure variable)
  - 1 for parameter structure member values (0.25 for each member).
  - 1.5 for values of dist variable (0.5 for ? and 0.5 for updated values)

-0.5 for adding ? in structure variable members

Exchange of values between working memory — 2 marks

1 for each arrow

-0.5 if multiple arrows shown for updating values of the parameter

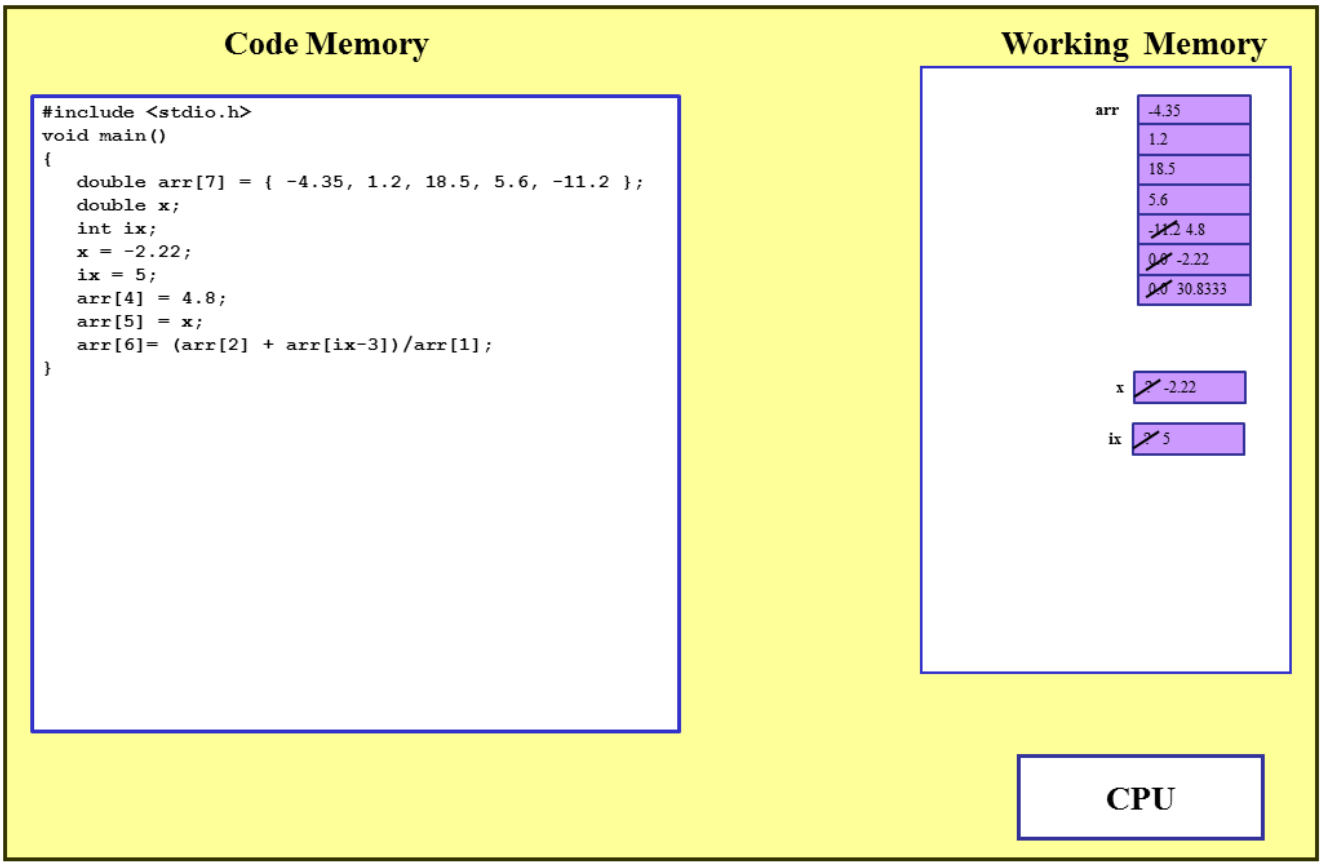
Console Output

0.5 mark for each output line — 1.5 marks

-0.5 if formatting of values are not correct (only 2 decimal places in fraction of structure member values and 4 decimal places in fraction of d)

Total — 10 marks

(b) (5 marks)



Marking Scheme:

Creating the array in memory — 1 marks

0.5 for drawing array in working memory

0.5 for proper initialization (0.25 for first five elements, 0.25 for zeros in last elements)

-0.25 if 8 elements are not present (ex. only 5 elements)

-0.25 if ? included in values of array elements

Defining variables x and ix in memory with values — 1 mark

0.25 for variable x, 0.25 for value, -2.22, including ?

0.25 for variable ix, 0.25 for value, 5, including ?

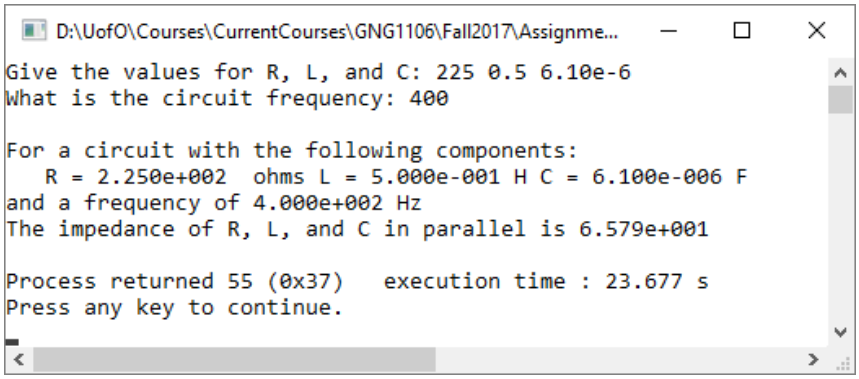
Results for each operation (1 for each update to elements in the array)	3 marks
Total	5 marks

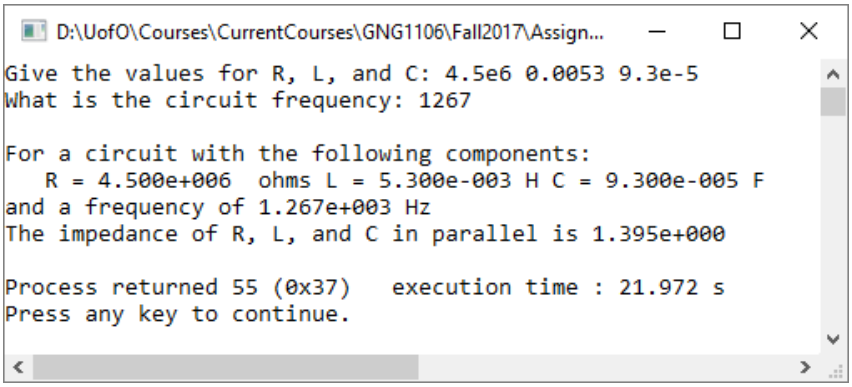
Question 2 (10 marks)

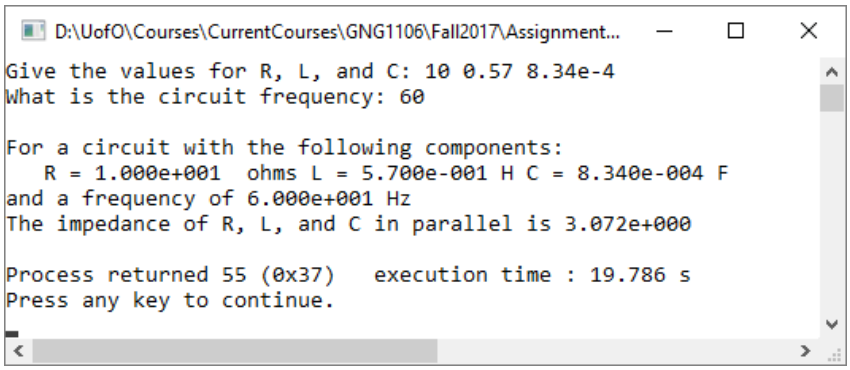
```
/*-------------------------------------------------------------------
File: a3_q2.c
Description: Calculate the impedance of a circuit with 3 components in parallel.
-------------------------------------------------------------------*/
#include <stdio.h>
#include <math.h>
// Definition of the type CIRCUIT
typedef struct
{
    double r;  // resistor
    double l;  // inductor
    double c;  // capacitor
    double f;  // frequency in Hz
} CIRCUIT;
// Function Prototype
double computeImpedance(CIRCUIT);
/*-------------------------------------------------------------------
Function: main
Description: Request from the user the values of the circuit components
             compute the impedance and display results.
-------------------------------------------------------------------*/
void main(void)
{
    // Variable Declarations
    CIRCUIT circuit;
    double impedance;
    // Get input data from user
    printf("Give the values for R, L, and C: ");
    scanf("%lf%lf%lf", &circuit.r, &circuit.l, &circuit.c);
    printf("What is the circuit frequency: ");
    scanf("%lf", &circuit.f);
    // Get impedance
    impedance = computeImpedance(circuit);
    // Results
    printf("\nFor a circuit with the following components: \n");
    printf("   R = %.3e  ohms L = %.3e H C = %.3e F  \n",
           circuit.r, circuit.l, circuit.c);
    printf("and a frequency of %.3e Hz\n", circuit.f);
    printf("The impedance of R, L, and C in parallel is %.3e\n", impedance);
}
```

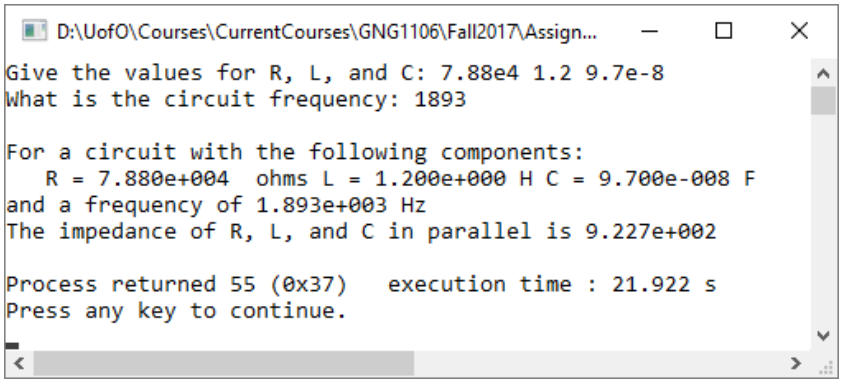
```
/*-------------------------------------------------------------------------
Function: computeImpedance
Parameters:
    circuit - contains circuit data including
              a resistor, an inductor, a capacitor and a frequency
              of the circuit
Returns:  The impedance of R, L, and C in parallel.
Description: Computes the impedance of a resistor (R), an inductor (L),
             and a capacitor (C) in parallel for a given frequency.
-------------------------------------------------------------------------*/
double computeImpedance(CIRCUIT cir)
{
    // Declaration of variables
    double imp; // impedance
    double omega; // frequency in radians
    // Calculation using accumulation
    omega = 2*M_PI*cir.f;
    imp = omega*cir.c - 1/(omega * cir.l);
    imp = 1/(cir.r*cir.r) + imp*imp;
    imp = 1/sqrt(imp);

    return(imp);
}
```

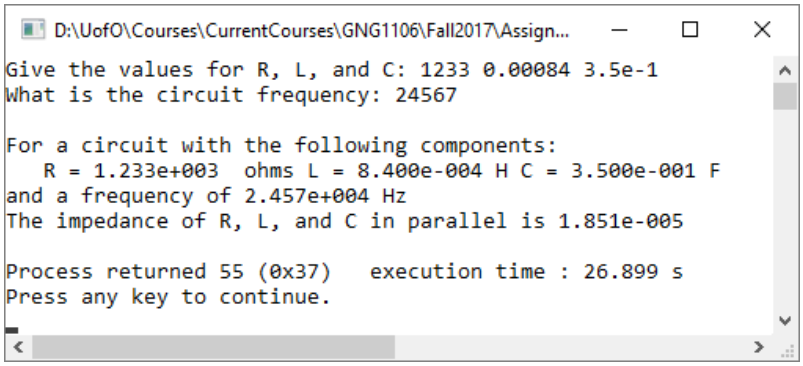
Output


D:\UofO\Courses\CurrentCourses\GNG1106\Fall2017\Assignme...
Give the values for R, L, and C: 225 0.5 6.10e-6
What is the circuit frequency: 400
For a circuit with the following components:
R = 2.250e+002 ohms L = 5.000e-001 H C = 6.100e-006 F
and a frequency of 4.000e+002 Hz
The impedance of R, L, and C in parallel is 6.579e+001
Process returned 55 (0x37) execution time : 23.677 s
Press any key to continue.


D:\UofO\Courses\CurrentCourses\GNG1106\Fall2017\Assign...
Give the values for R, L, and C: 4.5e6 0.0053 9.3e-5
What is the circuit frequency: 1267
For a circuit with the following components:
R = 4.500e+006 ohms L = 5.300e-003 H C = 9.300e-005 F
and a frequency of 1.267e+003 Hz
The impedance of R, L, and C in parallel is 1.395e+000
Process returned 55 (0x37) execution time : 21.972 s
Press any key to continue.


D:\UofO\Courses\CurrentCourses\GNG1106\Fall2017\Assignment...
Give the values for R, L, and C: 10 0.57 8.34e-4
What is the circuit frequency: 60
For a circuit with the following components:
R = 1.000e+001 ohms L = 5.700e-001 H C = 8.340e-004 F
and a frequency of 6.000e+001 Hz
The impedance of R, L, and C in parallel is 3.072e+000
Process returned 55 (0x37) execution time : 19.786 s
Press any key to continue.


D:\UofO\Courses\CurrentCourses\GNG1106\Fall2017\Assign...
Give the values for R, L, and C: 7.88e4 1.2 9.7e-8
What is the circuit frequency: 1893
For a circuit with the following components:
R = 7.880e+004 ohms L = 1.200e+000 H C = 9.700e-008 F
and a frequency of 1.893e+003 Hz
The impedance of R, L, and C in parallel is 9.227e+002
Process returned 55 (0x37) execution time : 21.922 s
Press any key to continue.



Marking Scheme:

C Program

- Structure definition — 2.5 marks
  - 2 for member definitions (0.5 for each member)
  - 0.5 for `typedef struct { } CIRCUIT;` (type name does not need to be `CIRCUIT`)
- Main function (5.5 total marks))
  - Comments (header) — 0.5 mark
  - Variable Declarations — 1 mark
  - Input from user — 1 mark
  - Call to computeImpedance — 1 mark
  - Display results — 2 mark
    - 1 mark for output (i.e. correct output for results as instructed)
    - 1 marks for formatting numbers as instructed
- Function computeImpedance (5.75 marks total)
  - Comments (header) — 0.5 mark
  - Function header/prototype — 1 mark
  - Variable declarations — 1 mark
  - Calculations — 2.75 marks
    - 1.25 mark for converting frequency to radians
    - 1.5 marks for calculation of impedance
  - Return instruction — 0.5 mark

Output (0.25 per output) — 1.25 marks

Total — 15 marks